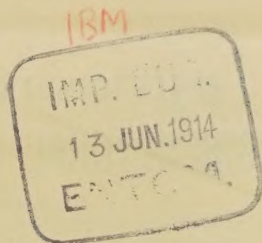


Moore R A

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OAT SMUT AND ITS PREVENTION.

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 The Bulletins and Annual Reports of this Station are sent free to all residents of the State upon request.

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GRAIN SMUT AND ITS PREVENTION.

R. A. MOORE.

OAT SMUT IN WISCONSIN.

During the past five years the Experiment Station has made extensive investigations concerning the prevalence and damages wrought by oat smut in this state, and has issued several bulletins on the subject. In these bulletins farmers have been warned of the existence of this evil, and have been given methods of prevention. So much has been said and done that we take it for granted that all Wisconsin farmers are acquainted with the importance of keeping the oat crop free from smut, and that it will not be necessary to go into minute details on the subject of prevention in this bulletin, but merely emphasize the importance of a continuance of the treatment of seed grain in accordance with the recommendations given. Farmers should continue the good work begun until the oat-smut evil is fully under control.

If a sum equal to the losses from oat smut for the past three years had been levied as a tax upon the farmers of the state, it would have amounted to \$13,500,000, or an average of four and one-half millions annually. The cost of maintaining all public schools, except those under city supervision, as reported by the Superintendent of Public Instruction, for the past three years was approximately \$11,500,000, or less than four millions annually. A conservative estimate, therefore, of the amount lost through the destruction of oats by smut for three years exceeds the money paid for public rural schools by something like two million dollars for this period. The annual cash school tax levy the farmer cannot and should not wish to avoid, for he receives in return the advantage afforded by the schools. What does he receive in return for the tax the smut levies upon him? Worse than nothing. He finds that after losing from ten to twenty per cent. of his crop of oats, the oat straw is partly damaged, and the oats secured which seem free from smut, have to a more or less degree the smut spores lurking beneath the hulls, waiting only the planting season to begin their deadly work. No farmer need have the smut tax levied upon him, for he can prevent all loss from smut by treating the seed grain in an inexpensive manner before sowing.

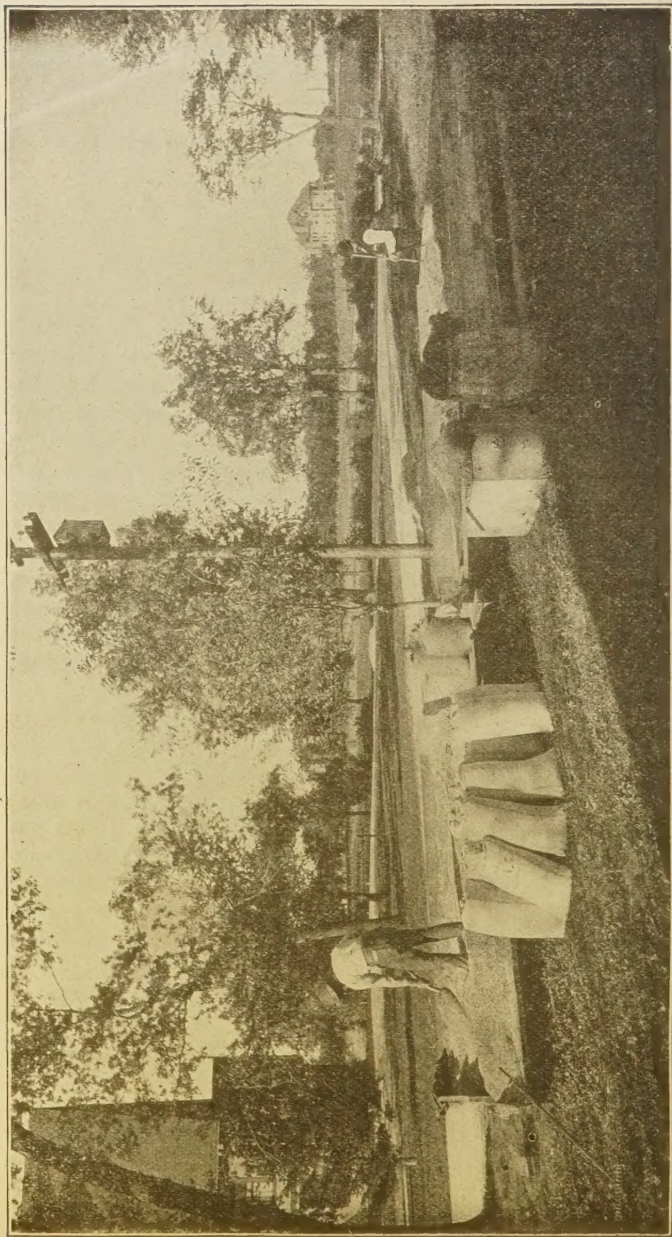


FIG. 1.—Treatment of seed oats for the prevention of smut by the formaldehyd method. Formaldehyd solution (one pint of formaldehyd to thirty-six gallons of water) in tank and barrel in the center of cut; oats having been submerged in solution draining on top of the tank and barrel. Treated oats emptied on two platforms to dry and shoveled over at intervals to hasten drying. Untreated grain in sacks to the left.

METHOD OF TREATMENT OF SEED OATS FOR THE PREVENTION OF SMUT.

A sufficient amount of formaldehyd should be secured from the druggist to treat the quantity of seed oats desired to sow for the season's crop. One pint of formaldehyd will treat thirty bushels of oats. The solution should be made by using one pint of forty per cent. formaldehyd to thirty-six gallons of water. The solution should be placed in barrels or a tank and the bags of oats should be submerged in the solution for at least ten minutes. (See fig. 1.) Gunny sacks are preferable to the grain bag in which to put seed oats when the desire is to treat them for the prevention of smut. When the sacks of oats are withdrawn from the barrels or tank they should be raised on the edge of the receptacle and allowed to drain, thereby saving considerable solution that would otherwise be wasted. The oats are then emptied on a threshing floor, platform, or canvas, to dry. Oats treated with the formaldehyd solution will usually dry sufficiently for sowing in one or two days. After treatment the oats swell considerably, and it is necessary for the seeder or drill to be set so that it will sow about one bushel more of the treated seed per acre than the usual amount of dry seed.

The formaldehyd solution used at the strength here recommended is not poisonous and will not injure the hands or clothing coming in contact with it. Oats that have been treated can be fed to horses when mixed with a like quantity of oats that have not been treated, without detrimental results.

Oats can be treated effectively several weeks or months previous to sowing if desired, and if properly dried the germinating qualities will not be impaired. This is important to seedsmen who dispose of large quantities of seed oats which should be treated in the fall and properly stored for winter sales. Seedsmen should either treat all seed of doubtful character or advise the purchaser to treat it. For the average farmer the time most convenient to treat seed grain is just previous to sowing. When treated in the fall, more care has to be exercised in drying the seed oats sufficiently to be stored.

It would seem from tests made at this Station that practically the only way seed oats become affected with smut is during the growing period at the time the oats are heading. The mature smut spores are then carried by the wind and lodge within the oat hulls, which close over the smut spores and thus protect them until sowing time.

When the seed oat starts to germinate the smut spore germinates also, and sends its tiny threads through the tissues of the oat plant with sufficient rapidity to reach its head and destroy the oat grains and produce its crop of deadly spores, which are matured at the proper time to inoculate the unaffected oats. (See fig. 2.)



FIG. 2.—Heads of oats affected with smut in different degrees. (Goff.)

BARLEY SMUT.

In some portions of the state barley is quite badly affected with smut. The same method of seed treatment prescribed for oat smut will be found effective for barley smut, excepting the solution is made by using one pint of formaldehyd with twenty gallons of water, instead of thirty-six, as recommended for the eradication of oat smut.

The barley hull may be more resistant to the formaldehyd and offers better protection to the smut spores than the oat hulls, or it may be possible that the smut spores of the barley are more resistant than the oat smut spores, consequently need a stronger solution for their extermination.

OAT SMUT INVESTIGATIONS DURING 1901 TO 1903.

From investigations made by the writer and former students of the College of Agriculture in 1901, twenty per cent. of the oats were found to be affected with smut; in 1902, seventeen per cent., and in 1903, seven and two-tenths per cent. were affected.

This decrease has largely been brought about by the farmers treating their seed grain or securing the seed grain from neighbors or seedsmen who had previously treated their seed. The large decrease from 1902 to 1903 in smut was not only due to the extensive treatment, but also from the fact that the season of 1902 was an exceptionally wet one. Oats in many parts of the state lodged badly, and the smut spores were washed into the ground by frequent showers and were thus prevented from inoculating the crop. Many of the tests made in fields in 1903, and reported untreated, were found to have been sown with oats, the seed of which had been treated one or two years previous and consequently had a low percentage of smut.

If seed grain is thoroughly treated once, several years will elapse before the smut becomes again serious.

OAT SMUT INVESTIGATIONS IN 1903.

The object of the investigations in 1903 was to determine: First, the relative proportion of farmers who had treated seed grain for prevention of smut; second, the inspection of fields to determine the amount of smut present where the seed was treated and where sown without treatment; third, the approximate amount of formaldehyd sold to farmers.

In order to ascertain the proportion of farmers who had treated seed grain for the prevention of smut, several hundred investigations were made. One hundred members of the Wisconsin Experiment Association were asked to make personal inspections in their respective locali-

ties. The work was to be done by visiting consecutive farms on some main road and by making tests in oat fields and by inquiry to get the desired information. Eighty-seven made observations and reported as follows:

Whole number of inspections made.....	476
Number of farmers who had treated seed for the prevention of smut	165
Number of farmers who had not treated seed.....	311
Average per cent. of smut in fields where seed was not treated	5.5
Average per cent. of smut in fields where seed was treated ..	.7

Report blanks were sent to one hundred former dairy students who were operating creameries and cheese factories in different counties of the state, with the request to ask their patrons whether or not they had treated their seed grain for the prevention of smut.

Reports from forty-seven factory operators show that of one thousand and eighty-eight farmers asked, two hundred forty-six had treated their seed grain for prevention of smut and eight hundred forty-two had not.

The writer in person made investigations in twenty-one counties of the state, visiting three hundred and thirty-two farms.

It was found that eighty-seven farmers had treated their seed grain for the prevention of smut, and two hundred and forty-five had not treated. Where the seed grain had been treated no smut, or only a trace was present, and where not treated, nine per cent. was present.

Oat smut investigations made by R. A. Moore.

County.	No. of farms visited, 1903.	SEED OATS.		Average per cent smut found.
		Treated.	Not treated.	
Dane	52	38	14	3.6
Dodge	10	0	10	6.6
Jefferson	17	0	17	6.3
Waukesha	24	6	18	10.0
Green	9	0	9	9.0
Rock	19	4	15	13.
Walworth	10	2	8	9.4
Racine	22	4	18	6.6
Sauk	19	4	15	18.0
Monroe	6	0	6	11.6
La Crosse	8	1	7	13.5
Wood	9	0	9	13.
Marathon	13	7	6	5.5
Clark	10	1	9	4.
Chippewa	17	1	16	10.
Eau Claire	11	0	11	11.
Fond du Lac	21	3	18	14.
Winnebago	9	2	7	5.
Marquette	8	2	6	9
Kewaunee	31	12	19	8.
Manitowoc	7	0	7	7.2
Average and totals.....	332	87	245	9.2

Report blanks were sent to approximately four hundred druggists of the state to report the amount of formaldehyd that had been sold to farmers for the purpose of treating seed grain for the prevention of smut, three hundred and sixty-four reported having sold eight thousand, seven hundred forty-eight pints. As the number of druggists reporting represent only about one-fourth of the whole number of druggists in the state, it seems fair to estimate the number of pints of formaldehyd sold by Wisconsin druggists in 1893 at 35,000. This amount represents the larger portion sold, but a considerable quantity is supplied to farmers by commercial firms of Chicago and elsewhere and by local dealers who are not druggists.

Summary of investigations made in 1903.

Experimenters.	Number.	No. of farmers visited or from whom inquiries were made.	No. of farmers who treated seed grain.	No. of farmers who had not treated.	Per cent treated seed.	Smut in treated seed.	Smut in untreated seed.
Members of Experiment Association	87	476	165	311	34.6	Only a trace.	5.5
Former Dairy Students....	47	1,088	246	842	22.6	No investigation.	
The writer	1	332	87	245	23.2	Only a trace.	9.
Average and totals...	25	1,896	498	1,398	26	Trace.	7.2

From the above summary we note that over one-fourth the farmers visited or from whom inquiries were made had treated their seed grain and in every case the smut was entirely eradicated, or nearly so.

SUMMARY.

Oat smut is prevalent throughout the state. During the past three years the destruction of the oat crop of Wisconsin farmers by smut amounted to \$13,500,000. The support of the rural public schools in the state has cost for three years, ending June 30, 1903, \$11,500,000, or \$2,000,000 less than the estimated value of oats destroyed by smut.

Where farmers have used the formaldehyd treatment as directed by the Experiment Station, or secured seed oats from farmers who have used the treatment, the crop was free from smut or only a trace could be found, and the smut in the state has thus been appreciably lessened.

The increase of smut is checked and retarded during wet seasons. This is especially true where oats lodge and subsequent rains wash

the immature smut spores on the ground. When oats lodge before maturity, the vitality of the grain is greatly impaired, and if retained for seed will usually result in producing only a partial crop.

Barley smut can be eradicated by submerging the seed grain for ten minutes in a solution made by using one pint of formaldehyd in twenty gallons of water.

By the exercise of constant vigilance on the part of the farmer and seedsman it seems that smut can be practically controlled in the future.